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APRIL, 1943

Oral Surgery

including

Oral Medicine, Pathology, Diagnosis, and Anesthesia

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Original Articles

A SUMMARY OF THE TREATMENT OF PERIODONTAL DISEASES

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AS IN the therapy of any disease, periodontal treatment must be based on a correct diagnosis. This necessitates an understanding of the pathologic changes going on in the periodontium and their correlation to the clinical symptoms. This knowledge combined with an understanding of the etiologic factors that are responsible for the disease, will aid the dentist in selecting a method of periodontal therapy which will best remove the exciting causes. The treatment of periodontal diseases consists of three phases: (1) The removal of the etiologic factors, (2) the correction of the symptoms, and (3) the institution of procedures for the maintenance of health.

LOCAL PROCEDURES

Removal of Direct Irritants.—In most instances the removal of direct irritants will correct some of the etiologic factors and alleviate the symptoms. Removing the supragingival calculus and polishing the teeth rids the mouth not only of irritants but also of the septic material in the periodontal pockets. This process is termed odontexesis. It requires a definite and exacting technique by means of instruments designed for this purpose. As a rule, each tooth in succession should be consistently and thoroughly cleansed and polished. It is good practice to divide the mouth into four quadrants and operate in one quadrant at a time. When the surfaces of each tooth are smooth and well polished, the shallow pockets will disappear unless the cause is of a mechanical nature, such as overhanging fillings, lack of contact points allowing for food impaction, faulty crowns. All these conditions that have been recorded in the examination chart as etiologic factors must be corrected; usually when this has been done many suppurating pockets will heal without further treatment.

Therapy of the Periodontal Pocket.—When a periodontal pocket is so deep that it will not disappear with ordinary prophylactic care, it is necessary to resort to other methods. These include subgingival curettage, flap operation, and gingivectomy.

SUBGINGIVAL CURETTAGE

Subgingival curettage consists of cleansing the root surfaces of the tooth, and removing the epithelial lining and inflammatory connective tissue in the pocket. For this procedure thin-bladed instruments which will pass into the gingival crevice without distending it should be used. The operator must develop sufficient skill to enable him to determine whether he has penetrated the entire pocket, even though the pocket may be in a spiral around the tooth. He must also know whether he has removed all the calculus and not merely rounded off projecting parts. A high degree of the sense of touch must be developed to master this technique. After the cementum and the wall of the pocket have

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been curetted, blood should be allowed to clot in the pocket. If the operation has been successful, the soft tissue will become attached to the tooth clinically, and a probe cannot be passed into the previously existing pocket.

FLAP OPERATION

Another procedure for the eradication of the periodontal pocket is the flap operation, which in theory is the same as that in subgingival curettage, but according to some periodontists has the advantage that the field of operation is open allowing one to operate under direct vision. There is no doubt that this method does not require the exacting technique necessary for effective subgingival curettage.

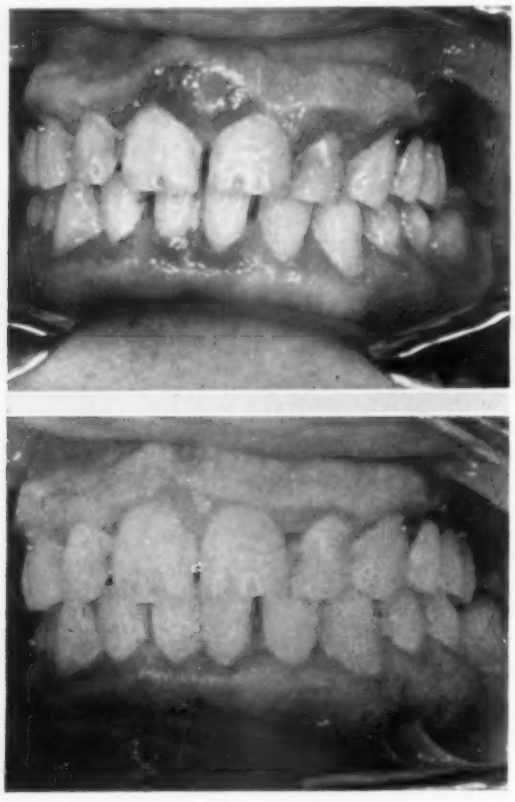

Fig. 1.—Before and after photographs showing the changes in the gingiva five days after the removal of supragingival calculus.

The technique is as follows: The mouth is cleaned with an antiseptic. A thin-bladed knife is passed into the interproximal tissue separating it into two parts, allowing a flap to be retracted labially and another lingually. The teeth are cleaned and the epithelial lining along with the inflammatory granulation tissue is removed. The wound is then washed with an antiseptic solution. The flaps are closed by passing sutures labiolingually through the interdental space. It is not necessary to use a pack.

GINGIVECTOMY

Many periodontists prefer gingivectomy, a third method to treat the periodontal pocket. Gingivectomy may be accomplished by surgery, chemical cau-

terization, or electrosurgery. It is my opinion that, as a rule, this method should be used only after subgingival curettage has failed. Gingivectomy seems indicated, however, in cases of hypertrophic gingivitis or if a pocket is so situated that it cannot be easily reached for instrumentation. In many cases the mechanical shape of the root does not allow for a reattachment of the tissue. This is particularly true in multirooted teeth when the tissue in the bifurcation is detached. One important phase of gingivectomy is that in removing the periodontal pocket the cut should be made in a direction similar to that of a normal gingival attachment. Only the free gingival tissue should be removed.

Gingivectomy by surgery should be performed with anesthesia, preferably local. The mouth should be washed with a solution of castile soap and sponged with an antiseptic solution. The depth of the pocket may be outlined on the outside of the gingiva with a sterile indelible pencil. An incision is then made following this outline. The gingiva is removed from the tooth with small knives or sharp pointed scissors. After bleeding has stopped, a pack should be placed on the wound surface.

Fig. 2.—Photomicrograph showing an instrument in place for the removal of calculus. *Ca*, calculus; *G*, gingiva; *B*, bone.

Gingivectomy by chemical cauterization accomplishes a similar result and is simple in application. However, extreme care must be employed because if too much of the escharotic drug is used, the crest of the alveolar bone may be destroyed. The procedure is as follows: The section to be operated is blocked off with gauze or cotton rolls. Phenol or any other escharotic is applied to the gingival crevice. After two or three minutes the surplus is wiped off and a saturated solution of sodium bicarbonate is used. Three to five days later a strip of necrotic tissue exfoliates. Cleansing of the tooth surface is done after healing is completed. One beneficial result of this method is that the sensitivity of the teeth usually encountered after surgical removal of gingival tissue caused by

sudden exposure of the root surfaces, does not develop, since the escharotic desensitizes the teeth.

Gingivectomy by the electrosurgical method can be done in two ways: (1) By electrocoagulation or electrodesiccation which is similar to gingivectomy with the use of an escharotic. The tissues are desiccated with either a monopolar electrode with the current for desiccation, or a bipolar electrode. Doing a little at a time with frequent treatments seems to be the safest method of application. (2) By use of a monopolar electrode serving as a knife with a technique similar to that in surgical gingivectomy. This method consists of the exact technique described in surgical gingivectomy. The advantages are that the posterior teeth and their bifurcations may be reached better than with a knife. Also, since the tissue is sealed as it is cut, no packs to protect the tissue are necessary.

Fig. 3.

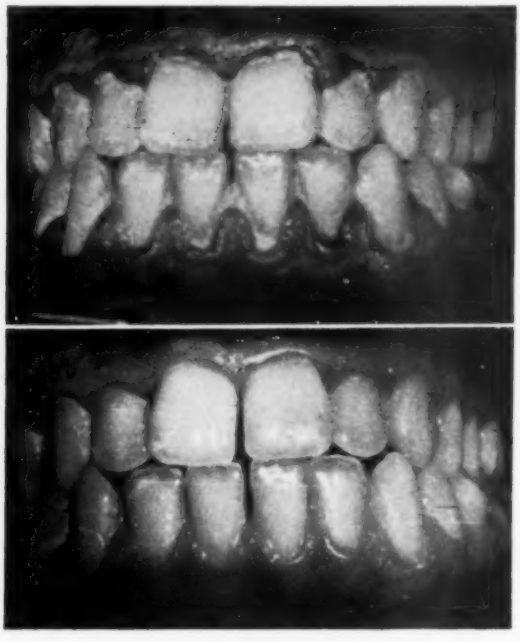

Fig. 4.

Fig. 3.—Photographs showing the gingiva before and after odontexesis and subgingival curettage. The inflammatory process has been eradicated and the gingivae hug the teeth in normal fashion.

Fig. 4.—Radiographs of a case in which subgingival curettage was performed, taken one year apart, showing the first and second mandibular left molars. Regeneration of the mesial alveolar bone and a new lamella dura is evident.

Restoration of Normal Function.—Restoration of normal function to a tooth may be thought of in two ways: (1) Normal occlusal function in relation to tooth anatomy, and (2) normal relationship to the other teeth in both arches. The occlusal surfaces should be restored by fillings if necessary. Spillways and marginal ridges must be present to prevent packing of food in the interproximal spaces. It is extremely important that all contact points between teeth be closed; this will prevent food impaction and the physiology of tooth support will not be disturbed. The fact that adjacent teeth receive support from one another has been demonstrated, and if the contact point is missing this support is lost.

Tooth loss is perhaps one of the most important factors in the breakdown of the periodontal structures. Since the teeth tend to drift and change their

occlusal relationships, overloading usually results. In the restoration of normal function, missing teeth must be replaced; this reconstruction may be accomplished by fixed or removable partial restorations. These restorations, how-

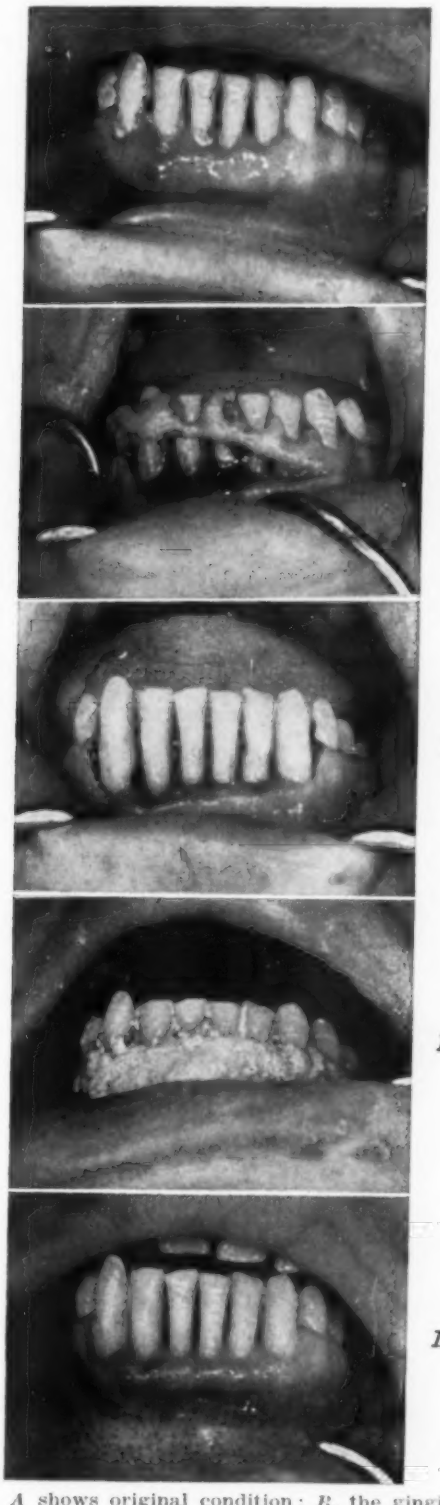

Fig. 5.—Gingivectomy. *A* shows original condition; *B*, the gingiva is being removed; *C*, bleeding has stopped, and the extent to which the gingivae were removed is shown; *D*, the pack is in place; *E*, three weeks after operation. (From Goldman: Periodontia, 1942, The C. V. Mosby Co.)

ever, must be designed to carry out therapeutic principles of stabilization and masticatory function. In this way harmonious relations between the teeth in the various positions of the mandible should be reproduced. It is essential that not only the centric position but also the other excursions of the mandible be correct.

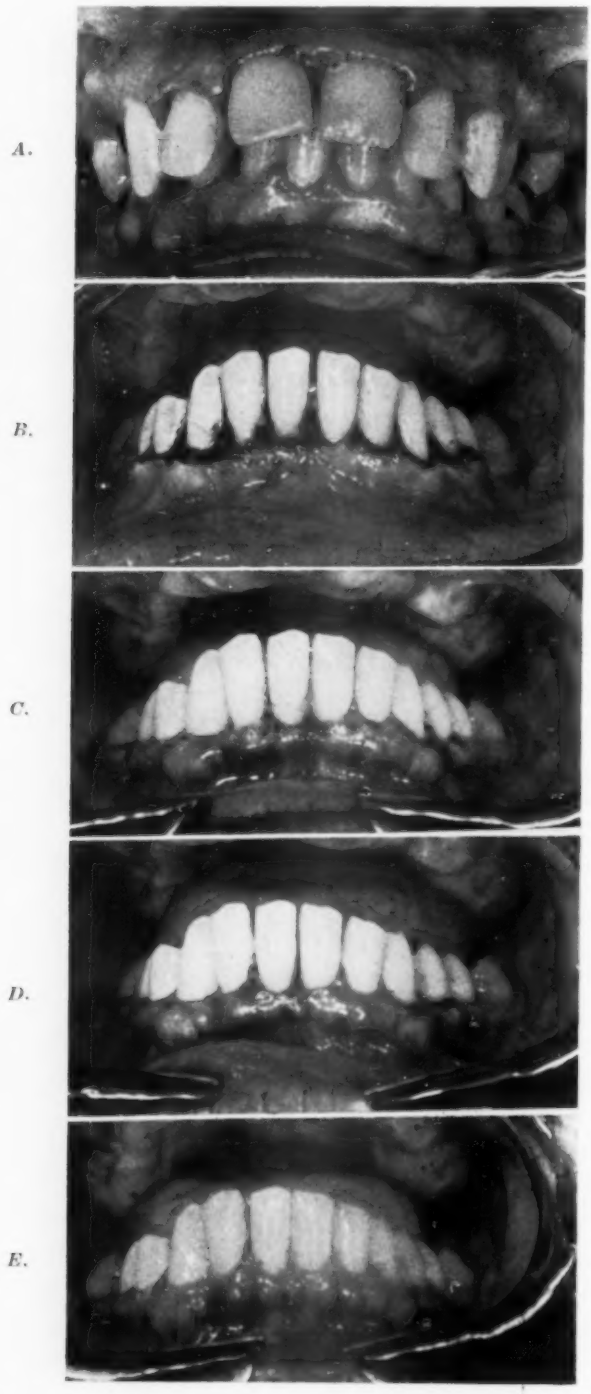

Fig. 6.—Eradication of pockets by electrocoagulation. *A*, original condition; *B*, after electrocoagulation; *C*, one week later; *D*, two weeks later; *E*, three weeks later.

Teeth which have lost much of their alveolar support may be splinted together. This is done in an effort to decrease the masticatory stress on the individual tooth. Splints may be of the fixed or removable type. It is my opinion that fixed splints are preferable where possible. A fixed splint may be constructed with its parts soldered together, or the parts may be interlocked by means of attachments which fit into one another. Removable splints may be employed very successfully, but a thorough knowledge of prosthetics with correlation of biologic factors is necessary. Experience in the construction of splints is important.

Where the incisal edges and the angulation of certain cusps of the teeth interfere in the movements of the mandible, the incisal and occlusal surfaces

Fig. 7.—Photographs showing the removal of gingival hypertrophy by electrodesiccation. *A*, original condition; *B*, after electrodesiccation; *C*, four days later.

may be reshaped by grinding. Judicious reshaping of the occlusal surfaces to reduce the areas of occlusal contact and increase spillways will help in the readjustment of a tooth. Grinding may also be employed to redistribute stress with the purpose of placing it upon stronger teeth and relieving weakly supported ones. However, it must be done with great caution. Casts of the teeth mounted on an articulator which permits movements similar to the natural movements of the mandible are necessary. The interfering cusps can readily be found and indicated with lead pencil on the casts. These findings are correlated with the x-rays. Frequently a tooth, the occlusal surface of which has been ground to lessen the stress on it, will be found in malocclusion again soon after the correction has been made. Therefore it is necessary to check these cases frequently.

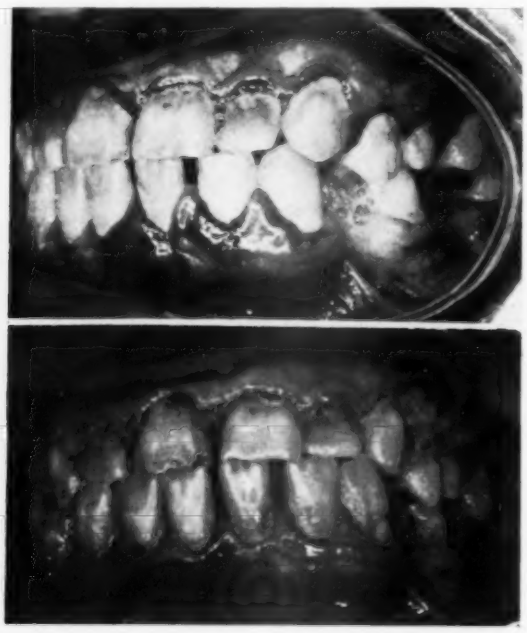

Fig. 8.—Photographs showing vitamin B deficiency, *A*, and the gingival change, *B*, resulting from therapy with vitamin B complex.

Home Care.—Home care plays an important part in the treatment of periodontal diseases. In many cases it is here that the difference between success and failure lies. It is important to impress the patient with the value of conscientious and correct toothbrushing, gingival massage, and the correct use of floss for interdental cleaning. Home care not only helps to produce a healthy state of the oral cavity, but it is the chief agent in the maintenance of health.

A technique of toothbrushing which obtains the maximum benefit from the cleansing and stimulating action of the brush with the least damage to the tissues should be taught the patient. Special care must also be given to the nonself-cleansing areas. The head of the toothbrush should be about one inch long and consist of six groups of bristles which are separated. The bristles should be of uniform length and stiff enough so that pressure can be transmitted through them to the gingivae. Hirschfeld's technique of toothbrushing is easy to teach and obtains very good results.

SYSTEMIC PROCEDURES

The relationship of systemic disease to periodontal manifestations has been demonstrated many times. There is no doubt that many diseases predispose to periodontal lesions. Cooperation with the physician is necessary to get his interpretation of the physical examination. In many cases no local causes are found and laboratory examinations are essential. *The findings will determine the systemic treatment that will be instituted.* Many times, however, no significant factors are found, and the systemic etiology cannot be determined definitely.

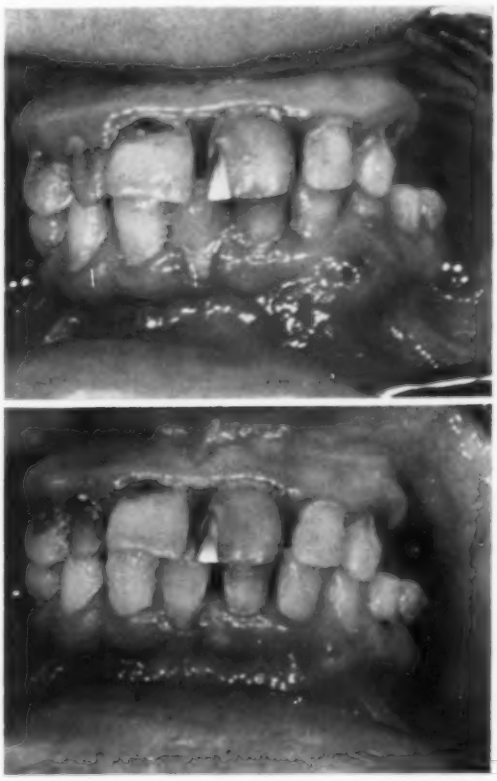

Fig. 9.—Photographs of a case of thrombocytopenic purpura treated only by instrumentation to remove the calculus. The gingival abscess was treated by subgingival curettage.

Systemic relationships are more often encountered when an already diagnosed systemic disease shows periodontal manifestations. An example of this may be seen in Fig. 8*A* which shows a gingival hypertrophy in a 30-year-old woman with marked tenderness of the gingivae and a burning sensation of the tongue. The tongue had the appearance of lingua geographica. The condition had been diagnosed as a vitamin B complex deficiency, and vitamin B complex prescribed. Fig. 8*B* shows the gingival condition six months later. The gingivae have shrunk and become attached to the teeth. Diagnosis of a systemic disease is important in the treatment of a periodontal lesion, for no matter what local procedures are instituted no permanent cure is possible unless the cause is removed. *It is true, however, that once a systemic periodontal lesion manifests itself, many of the symptoms must be alleviated by local treatment even though the cause may be removed by systemic therapy.*

In this respect it is interesting to cite the work of Campbell and Cook who treated fourteen patients presenting painful and bleeding gingivae with massive doses of ascorbic acid without any other dental treatment such as scaling or mouthwashes. Daily doses of 300 mg. of ascorbic acid were given until a urine test showed that the patient was saturated with vitamin C. On an average a total of 2,000 mg. was needed to bring results. In most cases the gingivae became normal after about four days' treatment. In these cases, however, the gingivitis could not be attributed to trauma, calculus, or administration of drugs.

Sinclair also found that in many cases of recurring Vincent's infection and periodontal disease, in which prior local methods of treatment had failed, the administration of large doses of vitamins A, B, and C gave gratifying results. In many selected cases, therefore, it is wise to prescribe a well-balanced diet containing all the necessary minerals and proteins. This can be supplemented with polyvitamin therapy, vitamins A and D, vitamin C, and vitamin B complex.

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ACTINOMYCOSIS

A Report of Twenty-Six Cases

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THIS is a report of twenty-six cases of actinomycosis treated at the Presbyterian Hospital in the city of New York during the past eighteen years.

Actinomycosis is marked by the formation of slow-growing granulation tissue and multiple abscesses, with eventual breakdown and discharge through multiple sinuses. The exudate may contain the characteristic minute yellow "sulfur" granules. The disease may be local or generalized with metastatic abscesses. It occurs infrequently, but with improved methods of diagnosis other mycoses are being transferred to the actinomycotic group.[1]

It is world wide in distribution. No age group is immune. The greatest incidence is roughly between the ages of 20 and 60 years; the smallest incidence is in children under 10 years of age. It is as prevalent in urban as in rural populations.[2] Males are more commonly affected than females. Of the specific cases reported here, most occurred during the third and through the sixth decades; the ratio of males to females was 3 to 2 (Table I).

Table I

Distribution

Decade	1st	2nd	3rd	4th	6th	7th
Number of cases	1	3	10	7	4	1
Number of males	58% of cases					

The complaints vary with the location of the lesion and the progress of the infectious process. Pain of varying intensities, often neuralgic in character, may be present. Stiffness of the region affected, owing to the swelling and induration, is common in head and neck involvement. Dysphagia and protrusion are complaints when the throat and tongue are involved.

The causative agent is the ray fungus, Actinomyces bovis, a pathogenic, nonacid-fast, anerobic gram-positive microorganism with or without clubbing on the ends of the mycelia. Bostroem, cited by Cope,[1] and others[3] state that the saprophytic, aerobic, acid-fast organism found in grasses and cereals is identical with the one recovered from actinomycotic lesions. Lord[4] reported actinomyces bovis to be a normal inhabitant of the mouths of many people showing no evidence of the disease. He found the fungi in gingival tissues, carious teeth, tonsillar crypts, and in salivary calculus and salivary duct stones. Soderlund and Naeslund stated that salivary duct calculi are formed by a deposit of insoluble salts on a basis of actinomycotic mycelia.[1] Appleton[5]

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observed that extraction of teeth, especially the lower third molars, abrasion or puncture of the oral mucosa by the dentist's instruments, and any other means by which the intact mucosa is broken serves as a portal of entry for the microorganisms. Such traumatic history was obtained in nearly all our cases involving the jaws.

Actinomycosis may attack any tissue or organ of the body, ranging from a local to a generalized infection. Some cases are limited to the gums and adjacent parts of the cheek. Cervicofacial infection is the most common form of the disease, the mandible being the most frequent site of primary involvement. The following is a comparison of the cases cited by Cope[1] and those studied by the authors.

TABLE II

LOCATION OF LESIONS	COPE	OUR GROUP*
Cervicofacial	55%	57%
Abdominal	20%	19%
Thorax	20%	22%
Rest of Body	5%	7%

*Three cases involved both "abdominal" and "thorax."

Actinomycosis begins with a cellular reaction in the soft tissues, the lesions varying from soft gelatinous granulation tissue to hard fibrous tissue resembling cartilage. One or more firm reddish or purplish infiltrated nodules may be seen. The soft material is observed in acute cases or in later stages of the more chronic cases. The swelling may include a hard nodule, a small or large "doughy" mass, a widespread "wooden-like" induration, or combinations of all three. The lymph nodes are usually involved but by centrifugal extension rather than metastatic. The largest swelling is noticed at the angle of the mandible and extends into the submaxillary, parotideomasseteric regions, and side of the neck. When the fibrous tissue reaction predominates, it resembles a hard scirrhous fibroma or fibrosarcoma and is called an actinomycoma. In the early stages, the symptoms may be typical of an acute, dentoalveolar abscess in the submaxillary region. It is often erroneously treated as such.[6]

The general course is slow, extending over a period of months or years. There may be acute flare-ups of a few weeks' duration on the chronic background.

Cases that terminate fatally (usually not the cervicofacial type) commonly run their course in about a year.

The infection burrows in subcutaneous, submucous, and subperitoneal connective tissue, gradually working its way to the external surface or into a body cavity. It spreads generally by direct extension centrifugally, but may metastasize through the blood stream.

In cervicofacial cases, the suppurative process almost always develops outward toward the skin, seldom pointing into the mouth. The overlying soft tissue where the abscess points becomes pink, purplish, or dusky red. It bursts and leaves a fistula, the infection invading further. The fistulous opening involutes spontaneously and leaves an atrophic, drawn-in scar.

The discharge is serous, purulent, or sanguineous and may contain the Drusen "sulfur" granules. The abscess starts as an inflammation that results in a fatty-like degeneration, forming the fluid of the abscess, resembling staph-

ylococcus pus but differing from it by the presence of necrotic tissue instead of polymorphonuclear leucocytes.

In the mandible, the infection frequently invades the periosteum, then spreads to the bone causing a true actinomycotic osteomyelitis. This is the nearest approach to lumpy jaw in cattle. The marked enlargement is caused by interstitial and periosteal formation of new bone while narrow tracts of granulation tissue, in which the fungus may be found, course through it. Sequestrae may form. Occasionally, central rarifying osteomyelitis is found.

Actinomycosis of the tongue begins as a hard nodule (1 to 2 cm. in diameter) situated in its substance. The nodule enlarges, becomes fistulous, discharges upon the surface, and heals. Or, it may spread to the floor of the mouth, producing the typical signs in the submaxillary region.

Pain may be absent, slight, severe, or neuralgic in character. In the latter instances, it suggests toothache. When the swelling is large, pain is usually mild. Secondary mixed infections, often painful, complicate the diagnosis.

The distinguishing characteristics of actinomycosis are its chronicity; multiple fistulae; exudate containing the "sulfur" granules; deep-seated induration; sinus tracts with orifices having a border of pouting granulation tissue; trismus in cervicofacial cases; dysphagia; and protrusion of the tongue.

Diagnosis is based on the clinical picture, finding of "sulfur" granules, smears, and culturing (deep dextrose agar shake cultures) of the fungi.

Actinomycosis may simulate many diseased conditions. It is often mistaken for tuberculosis, tertiary syphilis, neoplasia, or acute septic lesions. It may be differentiated from tuberculosis in that the latter is more chronic, is composed of multiple lesions that ulcerate, and a biopsy shows the characteristic picture. Laboratory tests are conclusive for each.

The gummas of tertiary syphilis present indurated crater-like ulcers in contrast to the multiple fistulae of actinomycosis. When the palate is involved, gummas leave perforated ulcers. Serologic tests are diagnostic.

Neoplasia follows a more stormy course than actinomycosis, and fistulae are not formed. Biopsy is usually relied upon to establish the diagnosis.

Actinomycosis may be differentiated from acute septic lesions because the latter subside readily on incision and drainage; and the lymph paths are more frequently invaded, resulting in general intoxication.

TREATMENT

If possible, all the forms of treatment should be given at the same time as follows (drugs are usually used singly):

1. *Drugs:* Potassium iodide, sodium iodide, ethyl iodide, Lugol's iodine, or colloidal iodine, copper sulfate. Sulfanilamide used over a long period of time may yield good results. Colloidal iodine is given intravenously, while ethyl iodide is inhaled. Iodine locally or in ointment form for inunction may be used where there is an open sinus, but as it does not penetrate deeply, potassium iodide by mouth, in large doses (as high as 250 grains or more a day) is used most frequently.

2. *Radiation:* X-ray, radium, ultraviolet light, and alpine light. X-ray is the most effective.

3. *Vaccine:* Autogenous vaccine is given when obtainable.

4. *General:* Well-balanced and nutritious diet with high vitamin content is supportive measure.

5. *Surgical:* Complete excision in the early stages is the ideal procedure. When the lesion is too extensive for radical removal, and natural drainage is inadequate, incision is indicated. The cavity is smeared with either 50 per cent or stick potassium hydrate. A solution of acid (usually acetic) should always be on hand when using this caustic. In one case the wound was dressed with gauze packing soaked in 20 per cent thymol in olive oil with good results.

CASE REPORTS

All the cases included in this report are tabulated in Table III.

The following two cases present general characteristics which are typical and were selected as representative of the maxillofacial group.

CASE 1.—A negress, aged 35 years, gave a history of pain and swelling in the lower left mandibular region and inability to open her mouth. The third molar, a bridge abutment, was painful for two months before it was removed. Pain persisted for two months more after which patient discovered a small hard lump (the size of a pea) on her lower jaw, just below the tip of the ear. Within the day, it had increased to the size of a plum. It was hard, reddened, but not painful. Within twenty-four hours it became highly inflamed and painful.

At this point, the patient came into the hospital where an infected tooth in the same area was extracted. The wound was irrigated for twenty days but the swelling did not subside, and trismus gradually developed. On palpation, the region was hard and nonfluctuant. An incision was made intraorally on the buccal mucosa of the molars and premolars, but no pus was found, although pus was found in the third molar socket. The radiogram showed a large rarefaction in the ramus continuous with the third molar tooth socket. At this juncture, the disorder was diagnosed as chronic suppurative osteomyelitis. The trismus increased and a month later three external incisions were made; one under the lower border of the mandible at the angle, another at about the center of the cheek, and a third just above the zygomatic arch. Foul-smelling pus and necrotic tissue were found which gave a positive smear and culture for actinomyces. This form of treatment was continued for a short interval but the swelling did not recede nor did the wounds cease to drain. The neck became swollen. There was subsequent difficulty in swallowing. Three months later the patient was given potassium iodide, ethyl iodide by inhalation, and ultraviolet light. Improvement was rapid and the patient was discharged. Duration of active treatment was about eleven months. The final diagnosis was actinomycosis of the skin and left side of mandible (Figs. 1, 2, and 3).

CASE 2.—Female, aged 20 years, gave the following history. Two years before admission the patient had an external swelling in the region of an impacted lower right third molar. The abscess was incised, but no pus was found. Progress was observed for three weeks, after which time she was hospitalized.

The third molar was extracted after three months of palliative treatment, but the swelling still remained, and a sinus developed at the angle of the jaw. The abscess was incised, and the exudate gave a positive actinomyces smear.

Treatment by ultraviolet irradiation and potassium iodide was instituted. No significant results were apparent for five months, after which time there was a marked improvement. Treatment was discontinued. Within three weeks, the condition recurred on the outer surface of the neck. A gradually increasing ankylosis developed, which receded when the abscesses were about to break down. About a month later, a peritonsillar abscess which developed was fulgurated. This was followed by a recurrence on the neck where two

Fig. 1.

Fig. 2.

Figs. 1 and 2 (Case 1) show swelling and multiple fistulae characteristic of actinomycosis. Photographs taken about nine weeks after onset of swelling. Course of active treatment was about eleven months.

Fig. 3.—X-ray of Case 1, taken at same time as Figs. 1 and 2, shows osteolytic areas in ramus of mandible.

pustules, 1 to 2 cm. in diameter, were observed. Nearby were healed scars from previously discharging fistulae which had closed. The patient was given Lugol's iodine and potassium iodide in doses up to 1000 grains a day (800 by mouth and 200 intravenously), deep x-ray therapy, and diathermy. There was no improvement. Fresh, painful swelling of the jaw developed and the radio-

TABLE III

CASE NO.	SEX	AGE	LOCATION OF LESION—REGIONS					SYMPTOMS												DURATION			RESULT				TREATMENT			REMARKS
			HEAD AND NECK	THORAX	ABDOMINAL AND PELVIC	EXTREMITIES	SKIN	SWELLING	PAIN	SINUSES	AFTER EXTRACTION	TRISMUS	LYMPH-ADENOPATHY	CACHEXIA	COUGH AND BLOODY SPUTUM	SORE THROAT	NASAL OBSTRUCTION	CONVULSIONS	WEEKS	MONTHS	YEARS	HEALED	IMPROVED	DOWNHILL NEAR DEATH	DIED	SURGERY	X-RAY	DRUGS	
1	F	35	4, 1 5, 6				√	√	√		√	√	√	√							12	√				√	√	√	
2	F	20	1, 5 6, 4				√	√	√	√	√	√	√	√							12	√				√		√	
3	F	11	1				√	√	√	√		√	√	√							1		√			√	√		Spread to eyelids—still under treatment
4	M	56	4, 1 5, 6				√	√	√	√	√	√	√	√						12		√				√	√		

Head and Neck:
1, face
2, chin
3, maxilla
4, mandible
5, submaxillary
6, neck
7, tonsil
8, nose
9, brain
10, skull

Thorax:
1, sternal
2, mammary
3, interscapular
4, lung
5, pleura
6, lateral costal
7, spine

Abdominal and Pelvic:
1, epigastrium
2, peritoneum
3, liver
4, spleen
5, appendix

Extremities:
1, arms
2, legs
3, fingers

5	F	23	7					√	√									2			√			√				
6	F	38		1, 2 3, 4	2		√	√	√	√				√	√					6					√	√			
7	M	20				3	√	√	√											6		√				√			Finger amputated
8	M	11		6, 7			√	√	√	√				√		√					1			√		√	√	√	
9	M	37		5, 6			√		√					√	√						13			√		√	√	√	Stormy course
10	M	50	3, 4, 1 5, 6				√		√	√	√			√			√				7		√			√			Still active
11	M	33	10	4, 5	√	√	√	√	√	√				√	√						6		√			√			Still slight drainage
12	M	30			5				√					√						5		√				√	√	√	
13	M	29	5, 6				√	√	√				√							3		√				√			
14	F	29	7					√	√										2			√				√			
15	F	28		4	5, 2, 3		√		√					√	√					3					√	√			
16	M	29	1				√	√	√											3		√				√			
17	M	24	1				√	√		√	√	√	√								2	√					√			
18	M	9	7					√	√										2				√			√			
19	F	25		4	1, 3, 2			√	√					√					2						√	√			
20	M	29	4, 5, 6				√	√	√	√	√	√	√	√						7		√				√	√	√	
21	F	13	7, 8					√	√				√			√				8		√				√			
22	M	35		1, 4, 5			√	√	√	√										2	2				√	√	√	√	
23	F	60			2		√	√	√	√				√						6					√	√	√	√	
24	M	59	8														√				2	√							
25	M	57	1, 8					√	√	√	√										27				√	√	√	√	Immed. cause of death was pneumonia
26	M	29	9			1	√	√	√	√								√	3						√	√		√	Finger amputated

gram showed an area of circumscribed rarefaction in the ramus. An incision was made along the lower border of the mandible to the bone and the area was curetted. The sinus in the neck was found to extend to the lower border of the mandible. The swelling became more pronounced and the entire right temporal and postauricular region became involved. The submental lymph nodes were enlarged but not tender.

Fig. 4.

Fig. 5.

Figs. 4 and 5 (Case 2) show swelling and multiple fistulae characteristic of actinomycosis. Photographs taken about seven months after onset. Course of disease was over two years.

Fig. 6.—X-ray of Case 2, taken about six months after onset, shows osteolytic areas in ramus of mandible.

The treatment consisted of iodides by mouth, intravenously, by inunction, and by inhalation; incision and drainage; ultraviolet and x-ray therapy; and an autogenous vaccine. After a period of two years, the condition was apparently cured.

The final diagnosis was actinomycosis of the temporal region, parotideomasseteric region, and lateral neck region (Figs. 4, 5, and 6).

DISCUSSION

Actinomycosis has long been a disease coupled in the minds of many observers with country life, originating from contact with infected cattle or chewing of hay or grasses. However, in the present series, only two of the twenty-six cases gave a history of rural environment. The literature cited here bears out the observation that the disease has no geographic limitations. The important factors necessary for its onset are the presence of the ray fungus (actinomycosis bovis is a normal inhabitant in the mouth) and an opportunity for its entry into the tissues by means of trauma. This is emphasized in our group by the history of trauma in the cervicofacial cases. Trauma as a predisposing factor is further exemplified in one case when actinomycosis developed on the knuckle of a finger after the skin had been ruptured by a blow against the tooth of an antagonist in a barroom brawl. Mere presence in the mouth of these organisms plus trauma are, in themselves, insufficient to produce the disease. Obviously, there are cases of trauma in mouths in which the ray fungus is present without actinomycosis resulting therefrom.

Slack[7] states that certain animal experiments have indicated that sensitization is necessary to produce experimental actinomycosis, and it is possible that sensitization is important in the human disease.

The fact that metastatic lesions may result from oral lesions points to actinomycosis as one of the focal infection diseases.

The best method of treatment is surgical. Early recognition and treatment make for favorable prognosis. In cervicofacial cases, mortality is low.

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SOME BIOLOGIC ASPECTS OF DENTAL VARIATIONS

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DENTAL literature on variations in human dentition was but scanty up to the beginning of this century. In 1909 G. V. Black published an extensive treatise on one particular phase of this problem, viz., supernumerary teeth. These were considered merely from the clinical aspect, since such teeth invariably require surgical intervention for the prevention of the displacement of adjacent teeth as well as for the elimination of a possible cause of reflex pain and for the improvement of the patient's appearance.

Although recent dental literature is replete with data on numerical variations, no general agreement may be discerned on the interpretation of this phenomenon. On reviewing this literature with its conflicting opinions, one is strongly reminded of the once greatly disputed question of morphogenesis, whether preformation (the form is given in the egg) or epigenesis (as a sculpture out of stone) were the cause of individual development. It was not until sufficient data of experimental embryology had been collected that the conception of dependent differentiation and evocation brought us nearer to the solution of this problem.

As variations in number of teeth of the human dentition may result from many causes which differ in principle, origin, and meaning, it seems appropriate to classify them on an etiologic basis in order that these irregularities may be the better understood.

A fully comprehensive study of the problem at issue involves a searching analysis into four different types of anomalies; viz., accessory teeth, missing teeth, diastemas, and, lastly, morphologic variations or unstable forms. An endeavor is made here to correlate the data of all these phenomena through the corroborative evidence presented by each of them and to show that they are all governed by the same principle and have many features in common.

Throughout our presentation of this subject we shall endeavor to differentiate between two distinct groups of dental variations: the prevailing one, apparently significant from the evolutionary point of view, being genetic in its origin, while the other group may best be explained by assuming an early injury to the embryo, which has affected the functional activity of the dental lamina. The evolutionary basis of excess and reduction of teeth, as well as of diastemas and rudimentary teeth, will be considered separately from cases of pathologic origin. As instances of the latter type may be cited in the first place odontomas, ovarian cysts (Fig. 1), and dens in dente (Fig. 2). Since these are phenotypical in character and have no phylogenic significance, they do not conform to the definition of supernumerary teeth proper, and hence are to be classified as monstrosities.

Read before the Jerusalem Dental Society, January, 1942, and the Tel-Aviv Dental Society, March, 1942.

SUPERNUMERARY TEETH

Most monographs take up the study of only one aspect of numerical aberrations, that of missing and supernumerary teeth. These should be considered as entirely separate problems. A number of investigators have, however, attempted to correlate the two as one biologic phenomenon (Thoma, Diamond, Middleton-Shaw).

With regard to supernumerary teeth, statistics available are not as yet sufficient for a definite conclusion to be drawn as to the percentage of their occurrence. The routine use of x-rays has brought to light numerous cases of unerupted supernumerary teeth, the frequency of such cases proving much greater than was formerly supposed.

Another point of significance is the almost constant position of supernumerary teeth, since they have a definite location in the dental arch, i.e., between the incisors (Fig. 3), in the region of the premolars, and posterior to the last molar.

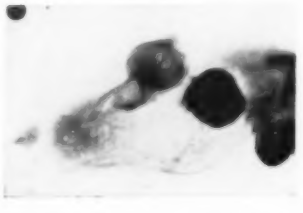

Fig. 1.—Part of mandible found in an ovarian cyst.

Fig. 2.—Dens in dente.

There are those, however, who evade this obvious fact by the vague assertion that supernumerary teeth have a tendency to develop the form of the teeth around which they are found. As a matter of fact they fail to realize that the pattern of any tooth among the various groups in the mammalian dentition is predetermined in the process of natural selection by such factors as location or function. As to supernumerary teeth they more often cease growing at an early developmental stage, and in the main they assume a rudimentary form, viz., a conical shape (Fig. 4). In these cases they can hardly be differentiated morphologically, being classified solely according to their positions, as is the rule with homologues in comparative anatomy and systematics.

The prevailing opinions concerning the origin of supernumerary teeth are that these may be a result of overproduction by the dental lamina (Black) or of

segmentation (dichotomy) of a tooth germ (Lesche, Roese, Colyer). In both cases they are considered as accidental variations.

The hypothesis of reversion of the dentition to a more primitive type is strongly rejected by many authorities. Thus Gregory contends that supernumerary teeth are in all probability neomorphs and should be considered as such, as long as their precise parallel is not shown in the phyla.

To many other students of this question, however, the theory of reversion seems to have a greater appeal than that which considers this phenomenon as being either a freak of nature or an accidental splitting. Supernumerary teeth are assumed by them to be a reminiscence of teeth suppressed in the course of evolution (Bolk, Tomes, Shultz).

Fig. 3.—Supernumerary incisor.

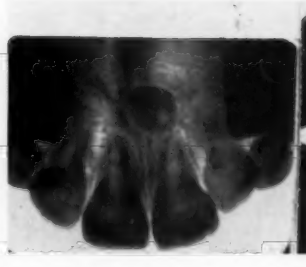

Fig. 4.

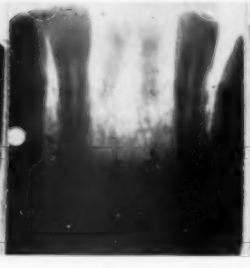

Fig. 5.

Fig. 6.

Fig. 4.—Supernumerary tooth in incisor region.
Fig. 5.—Bilateral occurrence of supernumerary teeth.
Fig. 6.—Missing teeth. First premolar decayed within the follicle; second premolar congenitally missing.

Dixon regards vestigial teeth or odontoids as remains of the reduced deciduous dentition, such as the tuberculum paramolare is considered by Bolk, while Proel and Adloff are of the opinion that the dental lamina, when abundant space is available, acquires the power of budding off more than the normal number of teeth. Such a harmony of a well-balanced interrelationship of teeth and jaws would indeed be ideal. This is, however, inconsistent with the fact that super-

numerary teeth frequently cause considerable deformation in the dental arch, as a result of lack of space for their accommodation.

A similar theory, if somewhat modified, was framed by Middleton-Shaw who held the opinion that the occurrence of a fourth molar is stipulated by the exuberant growth of the alveolar process. This explanation contradicts the well-known facts of odontogenesis, because a tooth never follows after the alveolar process, since the latter is only the function of the first, and since both tooth and its supporting tissue constitute a functional unit.

If we agree with Hrdlička and Shultz that missing teeth are an expression of the evolution of our dentition in a definite direction, and that the dental series is steadily being reduced, it would seem to follow that the occurrence of supernumerary teeth is an evolutionary phenomenon of reversion on the assumption that such teeth at one time existed in the normal series. Hockenjos describes a noteworthy case of a family of forty-six descendants within four generations. Forty-two had normal dentitions while the remaining four showed a fluctuation of the upper lateral incisors. In the case of the mother this tooth was missing, while the daughter had a supernumerary one. Obviously, the alternating tendency toward fluctuation between phylogenic reduction and reversion is in this case clearly manifested.

Of special interest is the symmetric bilateral occurrence of supernumerary teeth in the same jaw, as shown in Fig. 5. This should definitely point to some factor of a higher order operating here and not merely to an accidental occurrence of a symmetric anomaly.

MISSING TEETH (HYPODONTIA)

A good many theories have been propounded to account for this anomaly. In discussing the problem as a biologic phenomenon, care must be taken to exclude cases of a specific pathosis such as destruction of tooth germs at an early stage due to trauma or infection (Fig. 6). The term hypodontia is applied to aplasia of the dental lamina resulting from pathologic factors. This type of deficiency is easily identified, as it is usually combined with concomitant lesions (ectodermal displasia) which affect the phenotype. Hypodontia in our classification is considered as an anomaly chiefly ontogenetic in character (Fig. 7) and should not be regarded as identical with oligodontia, by which term we designate reduction on an evolutionary basis.

Scattered through dental literature are descriptions of many cases of hypo- or anodontia caused by aplasia or atrophic degeneration of the dental lamina.

Embryologists and geneticists (Morgan, Child) assume the presence of a critically sensitive period for every forming organ, coinciding with the period of the greatest activity of its formative cells. The most active cells at a given period of fetal development are the first to be affected through inhibition of the metabolic processes, or a deficient diet.

Hale recently published data obtained in experiments on pigs with a diet deficient in vitamin A. Gilts were fed a vitamin A-free ration for a period of 160 days before breeding and during the first 30 days of the gestation. All pigs farrowed were blind. Obviously the eye defects were induced by the depletion of vitamin A, for no other cases of blindness had been known in the

herd since its establishment. The same sires, when bred to other sows, produced normal pigs.

A complex clinical picture presenting manifold lesions may at times be derived from a combined effect or summation of hereditary and acquired characteristics. In other cases overlapping factors make themselves manifest. Fig. 6 exemplifies such an interplay of genetic and extrinsic factors.

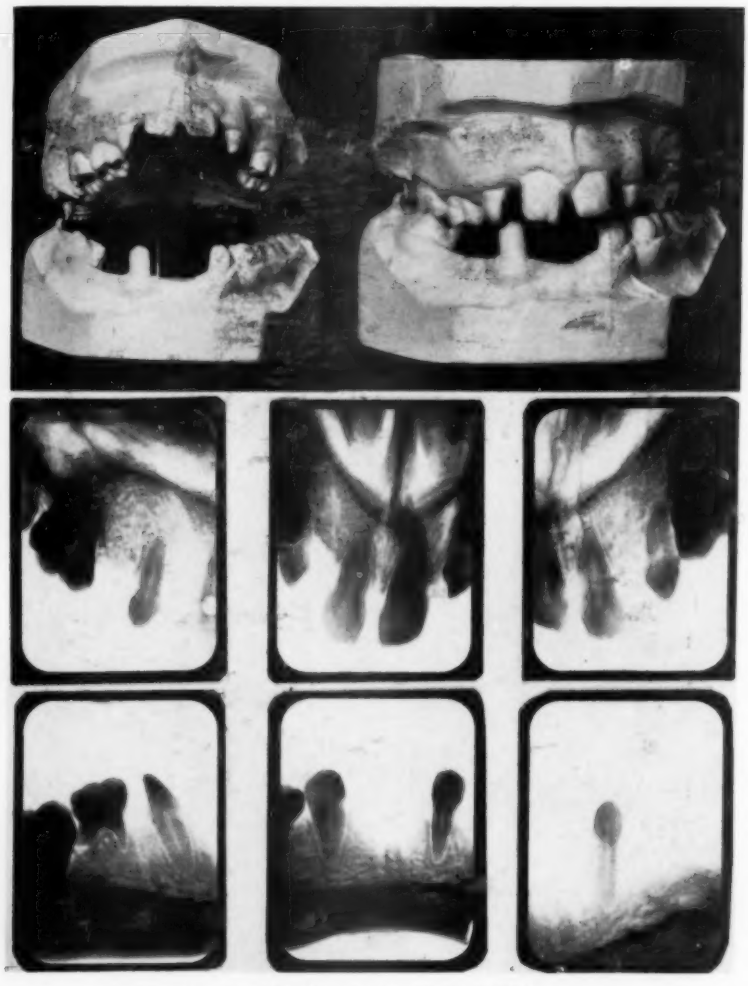

Fig. 7.—Missing teeth (hypodontia).

MISSING TEETH OLIGODONTIA

The phenomenon of the congenital missing of the anlagen of certain teeth (Fig. 8) is best viewed from an evolutionary aspect as an apparent expression of a process of continuous reduction of the number of teeth. This condition is regularly reflected in the progeny and should be distinguished from hypodontia which occurs at random and affects the phenotype. Werther and Rothenberg state, "Anodontia occurs with such regularity that one is led to the belief that it results from a well-determined reduction. Man in his earliest stage of development is supposed to have had a larger number of teeth than he has at present. Some of these teeth have been lost during his course of development.

This cycle has not yet been completed." Schaeffer expresses the same idea still more categorically for he states, "Since the typical mammalian formula is i 3/3,c 1/1,pm 4/4,m 3/3, it is believed that three pairs of teeth have been suppressed in the present human set. The missing teeth appear to be the second incisors and the first and fourth premolars." Occasionally, these suppressed teeth appear variously in the human jaw, giving rise to supernumerary teeth. Missing teeth may be considered as constituting another stage of the same phenomenon of plus and minus activity of the dental lamina, and may be explained in terms of genetics, as predetermined by heredity (Burks, Keeler). In accordance with the hypothesis that there is no genesis without a gene, Bateson postulated that missing teeth are caused by mutation through a loss of a gene, and introduced the term "discontinuous variation" to designate this anomaly.

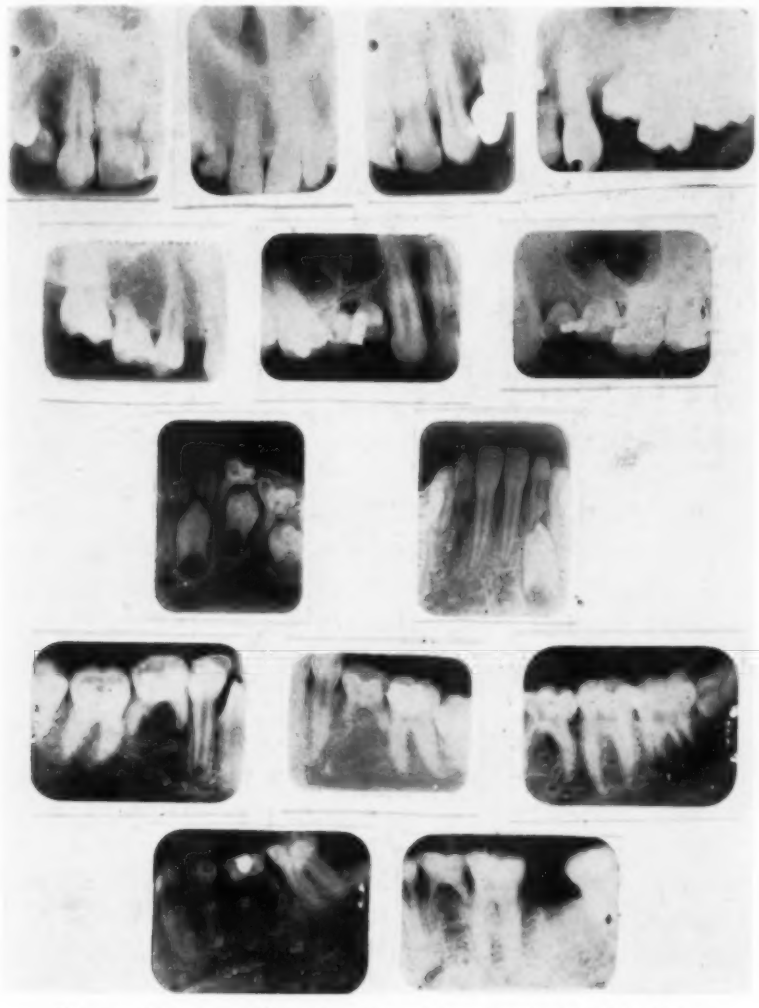

Fig. 8.—Roentgen films showing missing teeth (oligodontia).

STATISTICAL DATA

Dolder examined 10,000 school children in Berne, Switzerland, and found 3.4 per cent missing teeth and 0.3 per cent supernumeraries. A similar survey of 1,000 children made at the University of Pennsylvania Dental School showed

2.3 per cent missing teeth and 1.6 per cent supernumerary teeth. If we add the data of both missing and supernumerary teeth in each series and list them under one heading of numerical anomalies, we should get 3.7 per cent for Berne and 3.9 per cent for Pennsylvania. Dolder does not state whether complete x-ray examinations have been taken in all his cases. The real number might be much higher should the clinical examination be supplemented by x-rays in every case.

Stafne examined 48,850 successive individuals and found that the incidence of supernumerary teeth is at least one for every 100 persons. If diastemas were counted as spaces characteristic for lost teeth, these figures would be larger. We mention it here since the sporadic occurrence of diastemas, considered in terms of evolution, furnishes another point in favor of reversion to a more primitive dental pattern. Their relatively constant position, repeatedly encountered, corresponds to that of supernumerary teeth; namely, between the maxillary central incisors (Bolk's mesiodens), and in the mandible in the premolar region.

With regard to individual teeth, those most frequently missing, outside of the third molar, are the maxillary lateral incisor and the maxillary and mandibular second premolars. The maxillary lateral incisors alone are missing or vary in form and size in 3 per cent of cases examined.

Our records compiled from clinical and x-ray study of 1,490 children, aged 10 to 14, reveal a relatively high incidence of congenitally missing teeth, one of them traced for three generations.

We should be aware, however, that random statistics as mere figures are of a lesser biologic value if they are not followed up by field work in order to trace a certain feature on a family tree comprising many generations. This is virtually the assignment of practical eugenics to establish genetic endowment and hereditary laws of dominance or sex linkage. A still more important contribution is made by paleontology which gives us a better insight into the world of yesterday, since long range biologic changes have to be traced on a large time scale.

EVOLUTIONARY CHANGES IN THE JAWS

The reduction of the facial skeleton which houses the teeth is universally acknowledged. This idea of reduction results from findings in embryology, comparative anatomy, and paleontology. The conception of evolution is expressed by Vavilov in the law of parallel divergences in closely related types, and is concerned primarily with genetic material as well as with secondary adaptation to changes of environmental conditions.

The structural changes of the architecture of the jaw in the long path of phylogenetic development are numerous. Adaption to changed conditions, whether mechanical, climatic, or functional, is common phenomena in all bones. Some of the primitive conditions are ontogenetically repeated in the early embryologic stage, such as the symphysis and the separate premaxillary bone.

Other changes were developed at a later stage of evolution such as the ginglymoarthrodial joint, and the chin eminence which served as a new reinforcement for the weakened jaw usually associated with progress and mental

development. Hrdlička has exhibited several specimens of fossils of human mandibles as well as those of higher mammals, all showing a well-developed torus mandibularis (crista interna) which is mainly found in Pithecanthropus and in lower apes, baboons, chimpanzees. This greatly overdeveloped crista mandibularis interna, which resembles the massive torus, is sometimes still found in recent man, though such cases are very rare.

Hrdlička considers these an archaic phenomenon which reappears when changed conditions (coarse food) make greater demands on the masticatory efficiency of the jaws.

It is conventionally assumed that the reduction of the dental series followed the retrograde changes of the bony framework. According to the concrescence theory of Roese, fusion of teeth with reduction in number took place anteroposteriorly as a consequence of the shortening of the jaw.

Furthermore, early bone calcification and sutural disturbances were thought to account for the regressive formation, coalescence, or loss of teeth.

Direct observation, however, fails to confirm such a strict correlation; the higher degree of calcification of jawbones in later childhood is no hindrance to the formation of the permanent set of teeth. Bone is easily molded and gives way to pressure.

Calvelis reports a case with eighteen teeth congenitally missing, while the jaws developed to their normal size.

Similarly Thoma cites several cases with complete absence of teeth, which was in no way conditioned by lack of space, since the mandible was developed to normal size, though the stimulus from developing teeth was absent.

Frequently it is the mandible which lags behind in its development, while the number of teeth present is normal, though not in normal alignment; they may be crowded or impacted.

Thoma concludes that the controlling growth factor for the lower jaw is muscular function. The pull of the muscles of mastication is also considered as the causative factor for constant changes in the mandibular angle from early childhood to senility. The upper jaw has its attachment to nine bones of the skull and is still less dependent in its development on the mere number of teeth. Its growth is assumed to be controlled by the mode of breathing.

Pathologic conditions, moreover, affect teeth differently from jaws. Teeth, for example, are generally affected in cases of fluorosis, whereas jaws are more sensitive to factors causing rickets.

From the foregoing it appears that there is a certain autonomism in the development of jaw bones and teeth; that the retrograde changes in jaws are not determined by the elimination of teeth, and vice versa, bone changes alone cannot serve as the only criterion for tooth elimination, as hitherto assumed.

DIASTEMA

Systematic records of the occurrence of diastemas in man are not available, although they deserve more attention from a clinical and theoretical viewpoint. Discussion of spaces caused by acromegaly is not included here, since this condition is associated with a well-known pathosis, viz., disturbances in the pituitary gland. Nor is spacing caused by missing and lost teeth considered here.

Normally man has teeth arranged in a continuous arch, the structural elements of which are in close contact.

And yet we all know cases of a normal set of teeth, where the continuity of the arch is broken by unsightly spaces comparable to those occurring in the first dentition in anticipation of the eruption of the larger successors.

In the child these spaces are a symptom of growth. In adults they may be considered as deformities, as are gaps caused by missing teeth. Their location is as constant as that of the most frequently occurring supernumerary teeth, viz., between the central incisors and in the premolar region.

What is the significance of this phenomenon? According to Ritter, a diastema is an idiovariation which he attributes to the effect of a dominant gene.

In our opinion diastemas, as well as supernumerary teeth, are not idiovariations but may be interpreted in the light of evolutionary history. These spaces correspond to those once occupied by the mesiodens and the additional premolars; they remind us of lost teeth.

The fact that diastemas are confined to sites where reduction of teeth has undoubtedly taken place would appear to signify that these spaces are the closely guarded remains of teeth eliminated in the process of evolution, such as mesiodens and teeth in the posteanine region.

The phenomenon of reduction of teeth in predetermined locations and the characteristic occurrence of diastemas on such labile sites may lead to the conclusion that diastemas have some bearing on an ancestral formula when a greater number of teeth was present. This conclusion seems to be somewhat impaired by the fact that a living fossil (the primitive tapir) has retained his ancient formula of 44 teeth, yet a diastema nevertheless exists between the anteriors and the premolars. This diastema, however, as in herbivora in general, is functional, while diastema in rodents is a physiologic phenomenon providing room for the continuous growth of the apical end of the incisors.

On the whole, little attention has hitherto been paid to the biologic significance of diastemas in man.

REVERSION OF TEETH

On the threshold of development teeth had a conical form, and they were abundant in number. In the course of specialization two concurrent variations, inversely related, one quantitative and the other qualitative, took place.

In the early stage of evolution, reduction in number was associated with progression in form and with increasing complexity of cusps and enamel folds. In genus homo the height of this evolutionary process of progression was reached by early man, whose dentition was much more effectively specialized than that of modern man. Molars had more cusps and thick enamel; incisors had a well-expressed folded lingual tubercle; roots were sturdier and longer in relation to the shorter crown, although in comparison with molars of elephants and herbivorous animals in general the design of their teeth was less intricate.

The path of evolution then made a curve downward. This course of events accords with the law of Cope that unspecialized forms are able to develop, whereas progressive specialization results in decadent forms.

It is interesting to note that a greater number of varieties have been observed in teeth showing a tendency to disappear, as such teeth are not constant

in shape. Diamond, for example, mentions 250 various patterns for the crown of the second mandibular premolars. The third molar and the upper lateral incisor likewise show a great range of modifications.

Reduction in number is invariably preceded by regression in form, as we see in the instance of the third molar or the lateral incisor which are frequently conical in shape. We are inclined to consider the conical pattern as the decadent transitional form, before a tooth disappears entirely.

The occurrence of conical teeth is, however, used as an argument to discredit the reversion theory as a possible explanation for supernumerary teeth. It is claimed that conical teeth must necessarily mean reversion to an era so far removed from the present that the idea of reversion appears rather far-fetched.

The quantitative analysis of early tooth morphology carried out by Herzberg and Massler throws into greater relief the mechanism of the formation of conical teeth. Their experimental study included teeth of fish, frogs, alligators, snakes, and cats. They found that a basic similarity and correlation of tooth form and growth exist among all conical forms, regardless of the class to which the animal belongs. A conical tooth form is not a particular characteristic of the early evolutional stage, but results as a simple gradient pattern in accordance with a general law of growth.

Huxley has shown that there is no equal growth in all directions of development, i.e., the rate of growth is found to be at its maximal velocity at the growth center and decreases toward the periphery. The growth of cells varies according to three dimensions (base to altitude, labiolingual, mesiodistal). Since a tooth has two growth centers in opposite directions from the dentino-enamel junction, it tends to obtain a basic form of a cuspid type, as a result of the primary base-to-altitude gradient of growth. The formation of a complex morphologic pattern is apparently of a later phylogenetic origin and is therefore less stable, while the earlier stage of development (a conical form) may be longer retained.

Thus conical forms do not mean reversion a million years back, but illustrate a basic law of growth. They denote a mechanism and a stage of tooth development both in the species and in individuals.

HISTOLOGIC DATA

Black called our attention to streaks of epithelial cells observed in the dental lamina, which do not progress beyond the stage of initiation. Black suggested that these cells could at times give rise to supernumerary teeth.

Schour assumes likewise that remnants of the dental lamina may give rise to supernumerary teeth; he states: "The dental lamina finally becomes absorbed, the process starting at the anterior and proceeding posteriorly. Remnants of the lamina sometimes persist as epithelial pearls and may differentiate into supernumerary teeth."

These cells are later found imprisoned in the adjacent layers of the connective tissue and may sometimes give rise to neoplasms or monstrosities.

Our histologic study has convinced us that irregularities of the dental lamina are frequently found in human material. The dental lamina gives off many more projections, similar to those of developing buds, than the number of teeth

which actually develop. They may correspond to the genetically potential tooth buds, at present suppressed.

The photomicrograph (Fig. 9) of the dental lamina shows an example of additional projections which did not induce the proper response from the underlying connective tissue. Experimental embryology alone may perhaps reveal whether their stimulation gives the histologic basis for an increased number of teeth; experimental variations may reveal the motive forces of their development.

There is a strong argument against the supernumerary fourth molar as being a reversion, since a fourth molar has never been possessed by placental mammals. I should like to call attention, however, to the convincing biologic evidence for the assumption of Bolk and Norberg, that the first molar is the persistent third molar of the deciduous dentition, and the distomolar is consequently considered as a reversion of the third molar lost in the process of terminal reduction.

Fig. 9.—Tooth germ with extra buds given off by the dental lamina.

Dollo's law states that a structure once lost is never replaced. How is this law to accord with the occurrence of supernumerary teeth? Dollo came to his conclusion through the study of the evolution of the leathery turtle which changed its mode of life several times.

This law should, however, be considered rather as a rule having its exceptions. Besides, to assert reversion, we need not assume remote heredity. Additional teeth were known to have been found in fossil skulls of mammals continually throughout the ages. Our conception of reversion should not be based on the assumption that it means complete rehabilitation of the abolished principle of atavism. We are well aware that new factors come into play with every succeeding generation, so that reversion should be regarded as a spiral, on every turn of which situations, apparently similar, arise, each of which is, nevertheless, different from that preceding it. The term "neomorph" may hardly be justified as applied to supernumerary teeth. *Natura non facet salta.* Just as there is no new beginning of life with every individual, it is reasonable to assume that there can be no new organ which is not connected with some development in the past.

SUMMARY

The casual reversion to a primitive hypothetical tooth formula $\frac{3.1.4.3.}{}$, based on evidence from comparative anatomy and from the occurrence of supernumerary teeth, does not meet with common agreement. Stafne wonders: "If we assume that all supernumerary teeth which occur fall under the reversion hypothesis, an ancestral formula might be constructed which would include at least 52 teeth." Osburn is doubtful: "No fossil connective links have been found to support this hypothesis of reversion."

The evidence at hand, however, tends to confirm the reductional behavior of the dental arch. This tendency is not new with our generation. The retromolar pits or rudimentary alveoli are taken to bear a relation to the fourth molar, now suppressed. The third molars are also becoming extinct, while the second molars are losing the distolingual cusp, and their roots are tending to fuse. "The second incisor in Bantu, unlike the corresponding tooth in the modern civilized white, is rarely degenerate either in form or in size" (Middleton-Shaw). "The lower second bicuspids, frequently absent in whites, are very seldom found to be missing in the Eskimos of Greenland" (Pedersen).

We must search beyond the facts for a plausible explanation of them. Modern man has perhaps more teeth than biologically compatible with our species. If the theory of discontinuous variation, which designates loss of genes, holds good, more teeth would gradually be eliminated and the human race would in the course of time become edentulous, though the wheels of God grind slowly. Shall we comfort ourselves with the thought that in a less crowded mouth there will be less food impaction, hence less decay and less peridental lesions?

CONCLUSIONS

1. An attempt has been made to classify deficiencies in number of teeth into two groups:

a. Hypodontia (atelodontia) or losses through atrophy in an early embryologic stage, pathologically conditioned.

b. Oligodontia or losses on an evolutionary basis, through inactivation of the corresponding part of the dental lamina.

2. Supernumerary teeth in man are considered to have a phylogenetic significance. They may point to the past, as missing teeth may point to the future.

3. An opinion was expressed that diastemas should be considered as evidence of retention of an ancestral pattern.

4. It is pointed out that the dental lamina has a much wider range of proliferation than may be assumed by the number of calcified teeth.

5. Relatively high frequency, symmetrical occurrence and selective localization are salient features of numerical variations of human dentitions.

I wish to express my deep appreciation to Dr. M. Diamond, Head of the Division of Oral Anatomy of the Columbia University Dental School, for the privilege of having his guidance and encouragement and for his constructive criticism.

I am also indebted to Dr. McCall, Director of the Guggenheim Dental Clinic, for the facilities given to me to look over the x-ray records of the clinic.

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THE MAYAN SKULLS OF COPÁN

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THE Mayan civilization not only attained a high degree of culture in the arts and sciences but in the field of medicine and dentistry as well. In the years between A.D., 600 and 700, the Great Period of the Mayan civilization, the fine art of inlaying jade and iron pyrites or "fools gold" in the front teeth of priests and influential people was at its highest.

Under the capable direction of Señor Gustav Strömsvik, the Honduras Government and the Carnegie Institute are engaged in intensive archeologic and anthropologic exploration at Copán. It was through Señor Strömsvik's courteous cooperation that a great deal of data for this report was obtained.

So far two skulls have been discovered, one highly decorated with jade in the upper and lower incisors and the other void of any dental work.

THE SKULL OF AN INFLUENTIAL PERSON OR PRIEST

The skull that has the inlay work was discovered south of mound 32. The rest of the skeleton, not so well protected, was wholly destroyed. The skull itself is badly broken and incomplete. The two maxillae and the mandible are, however, in an exceedingly fine state of preservation. The teeth still have adhering to them the calcareous deposits that were present in life some 1300 years ago; and more remarkable still, the dental work that has stood up for thirteen centuries.

The teeth are of normal size; i.e., they comply with the average measurements given by most dental anatomy texts. With the exception of one small pit cavity on the occlusal surface of the lower right second molar, caries was not to be found. On the upper right cuspid where a jade filling had been lost, the cavity had decayed and involved the pulp. The entire set was well worn, showing attrition over and beyond what would be expected. All the anatomic occlusal markings are obliterated with the exception of small remnants of deep grooves. The facets of wear have replaced the cusps and ridges. The location of the pulp horns is easily distinguishable and the enamel is very thin there. On the left side the molars showed less wear and were covered, as were the lower incisors, with calcareous deposits on the gingival two-thirds. The upper incisors were covered with heavy calcareous deposits only on the lingual surface.

The incisors both upper and lower were decorated. Round fillings of iron pyrites and jade were inlaid on the labial surface of the teeth. The cavities drilled are perfectly round and the fillings fit so perfectly that no cementing medium can be seen. On the upper six anterior teeth are nine fillings, the most perfect work being done on the upper right central incisor. At the

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gingival third is a small black iron inlay and a jade filling at the incisal and middle third. At least three fillings are missing. The upper right cuspid has a cavity that has decayed and two other teeth have lost their inlays. Due to attrition some of the inlays are practically at the incisal edge and small pieces of enamel between the inlay and the incisal edge have broken off. The cavities are perfectly round, as would be made by rotating a hard, pointed instrument. In this case, a point made from the same material as the arrowheads and lances could have been used.

Destruction of the alveolar bone was observed. In the case of upper and lower anterior teeth the destruction of bone reached to one-half the length of the root. This was the case in the molar region also. No deep "pockets" were present.

The above observation of existing conditions, augmented by data and analysis of the habits and customs of the Mayan people, allows for certain deductions that in the absence of more exact information will help us understand conditions present at that time.

Fig. 1.—Copán. Head from southwest corner of Temple 22. (Photo, courtesy of Carnegie Institution of Washington.)

The skull is accepted to be that of a full grown, elderly male, an influential person or priest. The location of the find, the condition of wear of the teeth, the size of the jaws with prominent mental tuberosities, and the elimination of women as political or social leaders, preclude any other conclusion. It is evident that the inlays were done when this person was young and some years before his death. Some of the fillings are at the incisal edge showing where attrition has shortened the teeth considerably. Due to the excellency of the rest of the work, it is doubtful that the artist would place any of the inlays right at the incisal edge.

The man, after losing one or two of the fillings, became very careful and would not cut or bite with his anterior teeth. This is clearly shown by the

amount of calcareous deposits of the labial surface of the lower anteriors that reach up to the incisal one-third, and the deposits on the lingual of the upper and lower anterior teeth. This lack of proper use of the anterior teeth and the accumulation of deposits that overhang the gingival margin about two millimeters caused an irritation and infection clearly evident from the condition of the alveolar bone.

Fig. 2.—Lower jaw from Skull 2.

Fig. 3.—Occlusal surface of molars from jaw.

THE SECOND MAYAN SKULL

This skull was found very recently and in a still less preserved condition. The portion of the jaws that supports the anterior upper and lower incisors is missing and the statement previously made that the second skull is void of dental work should be qualified by saying that in the teeth found, there is no dental work. It is also to be noted that the lower cuspids that are present do not have any inlays in them.

The parts of the skull that are well preserved lend themselves to the study of dental conditions existing at that time. Although data from two skulls are insufficient to support sweeping conclusions, certain comparisons with today's conditions can be noted. Certainly, until data that would warrant a change or reversal of opinions come to light, these conclusions must represent one more link in the chain of information that has been so painstakingly gathered toward a fuller understanding of Mayan civilization.

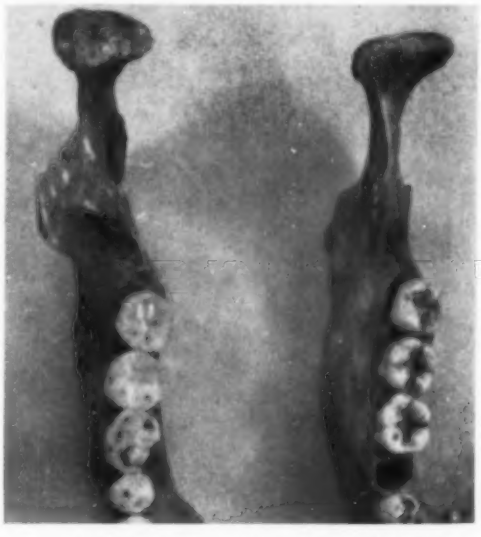

Fig. 4.—Comparison with modern jaw. Mayan jaw left.

Fig. 5.—Comparison with modern jaw. Mayan jaw below.

The two fragments of the jaw which have been found are from the cuspid to the third molar on the right side and from the first premolar to the third molar on the left side. The teeth are well worn. As in the case of Skull 1, all the marks have been worn off and are replaced by facets or wear. In modern times these teeth would be considered in an advanced state of attrition. Caries either on the occlusal surfaces or on the interproximal surfaces were

absent. X-rays failed to disclose any sign of arrested caries. These x-rays constitute, to my knowledge, the first x-rays ever taken of a Mayan from Copán.*

On the x-ray, Fig. 6, the loss of substance around the first premolar was due to fracture of small pieces of the alveolus supporting it. For this reason it no longer fits perfectly into place.

Fig. 6.—X-ray of right side of jaw from Skull 2.
Fig. 7.—X-ray of left side of jaw from Skull 2.

Fig. 8.—Facial characteristics of the Mayans. (See text.) (Photo, courtesy of Carnegie Institution of Washington.)

It is interesting to note that the roots show the same distinct regularity of root formation that is found today among the population having the highest percentage of Indian blood. The articulation as seen from the molars present is indeed very good, including that of the third molar. The condition of the alveolar process is that of health. There are no deposits anywhere, and the

*The x-rays taken by Dr. S. S. Grosjean were from a Mayan skull of the Ulua Valley (Uloa Valley) and not from Copán.

process is well calcified and reaches well around the teeth. The x-rays do not disclose any signs of infection of the alveolus. If we were to judge the age of the subject from the condition of the teeth and alveolar bone we would be inclined to think of a man of middle age from the well-worn condition of the

Fig. 9.—Jicaque Indian of today.

Fig. 10.—Skull 1. At the Mayan Museum at Copán, Honduras.

teeth, particularly the third molars; but on the other hand, judging the alveolar bone from present-day standards, we would think of the subject as a much younger man. There is no doubt that this attrition is due to the finely powdered stone that was incorporated into the corn as it was prepared on the "metates"

or stones. The finely powdered stone resembles very fine emery powder and has a high abrasive quality.

Other observations and comparisons of interest in anthropometric studies are the size of the ascending ramus of the mandible. Comparison with several skulls shows that the ascending ramus is shorter and thicker than contemporary skulls and that the horizontal ramus is much wider (from alveolar border to the inferior border of mandible) and thicker. The condyle is thicker and heavier and shows a flattened articulating surface. The fine sculpture (see Fig. 8) shows the facial characteristics of the Mayans; this same type of face is repeated over and over again throughout the discovered works of art. Comparison with the modern Indian (Fig. 9), a Jicaque from the only pure tribe in Honduras, high up in the Montaña de la Flor, shows that these Indians closely resemble the Mayans.

Whether we should consider these men artists, dentists, or skilled lapidaries is subject to discussion; the fact still remains that the work is beautiful and well done. When viewing this work, we cannot help but wonder at the dexterity of these artists whose product still stands though they have been dead these 1300 years.

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EPITHELIUM IN THE PULP

MYRON S. AISENBERG, D.D.S., BALTIMORE, MD.

THE presence of epithelium as one of the structures occasionally found in the dental pulp is mentioned in only one of the standard textbooks of dental histology.[1] The statement is made here that epithelial rests may be carried into the pulp from the periodontal membrane and their relationship to denticle formation is discussed.

Kronfeld[2] discussed the controversy concerning the origin of epithelium in dental granulomas.[3-10] Two views are presented by him: one, "that epithelium in chronic infections of the apical tissues of teeth has its origin in oral epithelium, and is always associated with a pre-existing sinus to the gingiva which may still be present or have become obliterated"; the other, citing various authors, "who look upon the epithelial rests of the periodontal membrane as the usual source of the epithelium in granulomas and cysts."

During the routine examination of teeth subjected to a variety of pathologic conditions and in one case of malignancy, it was observed that epithelium was present in the pulps of teeth. With the exception of the malignancy, this epi-

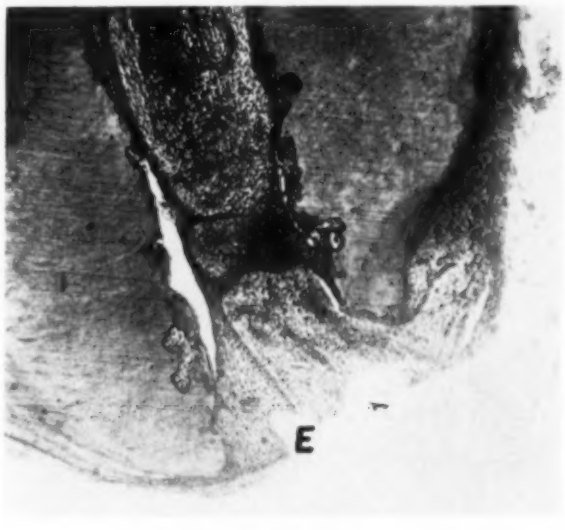

Fig. 1.

thelium was found to have migrated into the pulp from the epithelial rests of Malassez which were stimulated to activity mostly because of inflammatory changes. In all of the cases now being reported, no evidence of communication with the oral epithelium through a sinus was found.

From the Department of Oral Pathology, Baltimore College of Dental Surgery, Dental School, University of Maryland.

Read by title, 20th meeting, International Association for Dental Research, New York, March 14 and 15, 1942.

Fig. 2.

Fig. 3.

In the first case presented, Fig. 1, the epithelium lines the walls of the root canal of a mandibular second premolar whose pulp showed chronic ulcerative pulpitis with a granuloma. The epithelium, *E*, had migrated into the pulp from the epithelium of the granuloma.

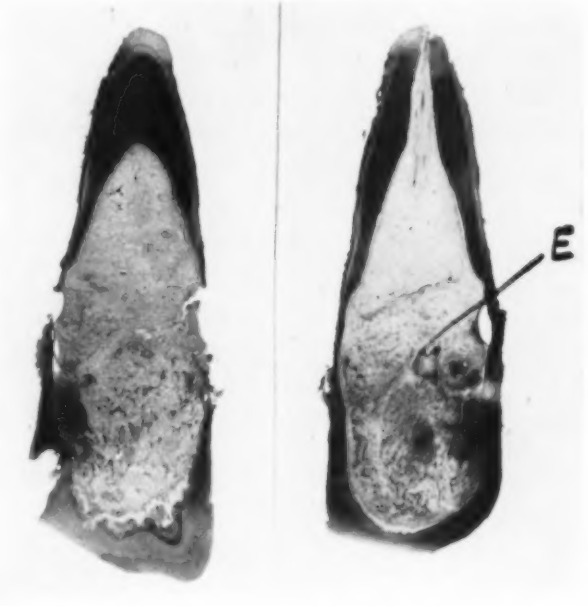

Fig. 4. Fig. 5.

Fig. 6.

Another case presented is that of a maxillary canine that once supported a pin-crown restoration. A lateral perforation was made during the preparation of this root for the pin. Because of trauma and subsequent attempt to repair, or because of infection or of chemical irritation by the cement used to retain the restoration, the epithelial rests of the periodontal membrane near the perforation were stimulated to activity along with the connective tissue elements

to produce a pericemental granuloma. Fig. 2 is a low-power photomicrograph showing the size and position of this granuloma. Fig. 3 is a higher magnification to show the proliferating epithelium, *E*, which had arisen from the epithelial rests. Attention to this granuloma occurred only after extraction, and because of its small size and position could not have communicated with the oral epithelium. In this specimen the epithelium had not migrated into the canal, and this is shown only to demonstrate that this epithelium originated from the epithelial rests. In the following cases where lateral perforations had occurred, epithelium is found to have migrated into the pulp. Figs. 2 and 3 are presented as corroboratory evidence that the source of the epithelium is from the epithelial rests.

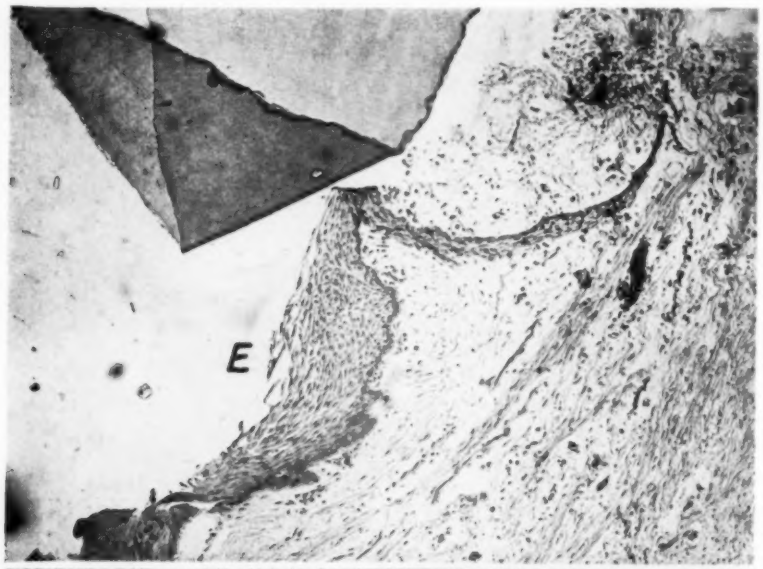

Fig. 7.

Fig. 8.

Figs. 4 and 5 are low-power photomicrographs of a case of internal resorption.[11] In Fig. 4, lateral perforations are seen. In Fig. 5, the same tooth but at a different level, we see the epithelium in the pulp at *E*. Fig. 6 is a higher magnification of this epithelium.

Fig. 7 is from another case of internal resorption showing epithelium, *E*, migrating into the pulp through a lateral perforation. In Fig. 8, at a different level, we see the epithelium, *E*, further into the pulp.

Fig. 9 is a radiograph of a mandibular second premolar showing a resorption area on the mesial surface of the root. Fig. 10 is a low-power photomicrograph of this tooth showing a small cystic granuloma, *G*, occupying the resorption area in the tooth which extends into the pulp. Fig. 11 is a high-power view of this cyst. The epithelium is seen at *E*. Strands of epithelium can be seen migrating into the pulp at *M*.

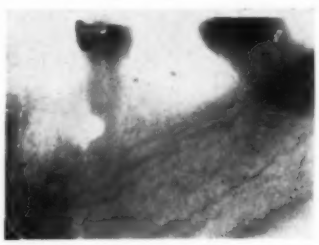

Fig. 9.

Fig. 10.

Fig. 12 is a radiograph of an incompletely calcified maxillary central incisor with a pulpal exposure of long standing. Fig. 13 is a low-power photomicrograph of this tooth showing the exposure at *C*. Food debris in the pulp chamber can be seen at *F*. The remainder of the pulp stump is lined with stratified squamous epithelium, *E*. This epithelium is attached to the dentine *D*, in a manner similar to that of an epithelial attachment of the gingivae at the neck of a tooth. Fig. 14 is a higher magnification of this epithelium, *E*. In the serial sections of this tooth, this epithelium can be seen to originate from the apical area, *A*.

If this specimen did not have a crown, the picture would be identical with that of a hyperplastic pulp. The origin of the epithelial lining of a hyperplastic pulp is said to begin from two sources; one, from grafts of desquamated epithelium "taking" on the surface of a raw bleeding pulp, the other, from

epithelial rests in the pulp. In this case, because of the small exposure, it is improbable that grafting took place, but because of the deep origin of the epithelium in the periapical tissue, it must have originated from the epithelial rests stimulated to activity by the inflammatory process.

Fig. 11.

Fig. 12.

Fig. 13.

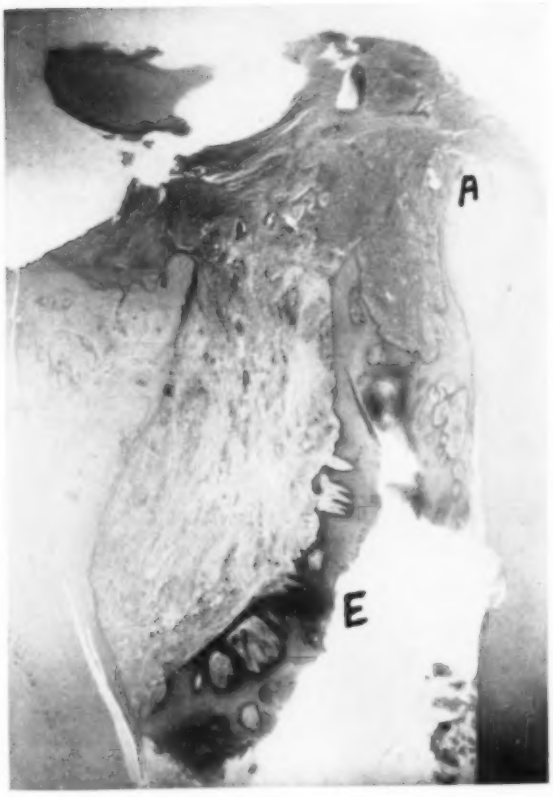

Fig. 14.

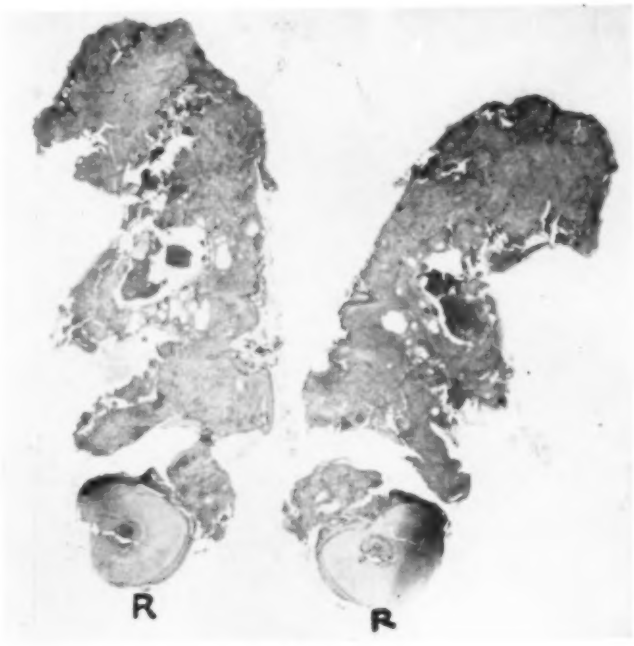

Fig. 15.

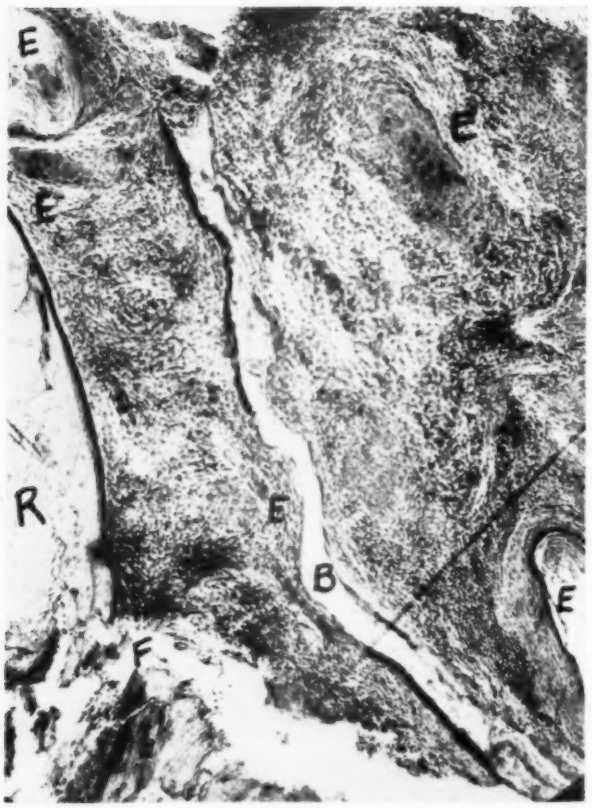

Fig. 16.

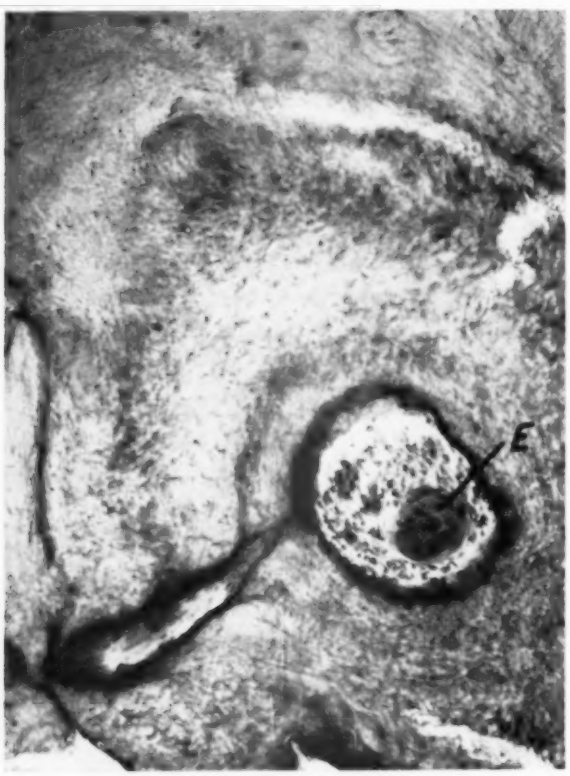

Fig. 17.

Figs. 15 to 18 are from a biopsy of a primary epidermoid carcinoma of the mandible. Fig. 15 shows two sections of this biopsy containing a retained root, *R*. Fig. 16 shows the root, *R*, apical foramen, *F*, and the remaining alveolar bone, *B*. Infiltration of the periodontal membrane and marrow spaces with malignant cells can be seen at *E*. Fig. 17 is a high-power photomicrograph of the canal in cross section showing malignant cells, *E*, in the pulp stump. Fig. 18 is a high-power view of the canal in another section cut in longitudinal direction at the apical foramen. The alveolar bone can be seen at *B*. Malignant cells

Fig. 18.

can be seen in the periodontal membrane and marrow spaces at *M*. Two strands of malignant cells in the pulp canal can be seen at *E*.

From the material presented we may conclude that epithelium is found in the dental pulp. It migrates into the dental pulp from activated epithelial rests. The epithelium enters through the apical foramen, through accidental root perforations and in cases of internal resorption. The origin of cysts of the jaw can be traced to these activated epithelial rests.

One case of metastasis of an epidermoid carcinoma into the pulp is presented.

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42 S. Greene Street

Case Reports

CASE NO 79

DENTIGEROUS CYST

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THE presence of certain oral lesions is not always detected in the casual examination of the buccal cavity. Because of the absence of obvious demonstrable changes in a slow-growing neoplasm, frequently the lesion will attain a size which, in its operative management, presents surgical as well as cosmetic problems.

The discovery of the presence of dentigerous cysts, when all the usual clinical evidence is absent, can thus be attributed to mere chance, if routine x-ray examination is not made of all patients. Edentate areas should be suspected if no knowledge of the previous extraction of permanent teeth exists.

The following case report clearly demonstrates the importance of the x-ray in supplementing clinical observation, especially in the late eruption or suspected congenital absence of teeth.

Case Report.—M. B., a well-developed, otherwise healthy white boy 16 years of age, was referred to this office for diagnosis and treatment. The past history was essentially negative. He was sent to a local dentist for the usual school certificate.

In a cursory examination of the mouth, his dentist noticed an edentulous space of the right mandibular molar area. Both arches were well developed with no other permanent teeth missing. Caries and fillings were remarkably absent. Inquiry disclosed no knowledge of teeth ever having been removed.

Regional Examination.—My examination revealed that both arches were well developed. There was neither caries nor fillings in any teeth. The color of the mucous membrane was normal. In the right mandibular edentulous space there was an apparent attachment of the mucous membrane of the cheek to the crest of the ridge. Retraction of the cheek at this point and palpation disclosed a bulging alveolus, and crepitation. This area—it was carefully noted—started in the region of the right mandibular second premolar and extended far beyond the normal landmark of the third molar with a corresponding exerescence of the lingual alveolus. Subsequently the external facies were examined, and while the asymmetry was not marked when first observed, drawing the skin of the face to either side of the inferior border of the mandible clearly outlined the external swelling to be about the size of a hen's egg. The well-rounded contour of the face had apparently concealed all clinical evidence of this large swelling.

Roentgen Examination.—Lateral jaw roentgenograms were made revealing an area of bone destruction, extending from the second premolar into the body of the ascending ramus. Expansion of the cyst not only caused a displacement

of the 12-year molar, but loss of root substance of the second premolar from impingement and pressure. The mental foramen, it is noted, is well outlined and intact (Fig. 1).

Fig. 1.—Roentgenogram showing extensive bone destruction with marked bulging of the thin cortex. Note particularly the displacement of 12-year molar.

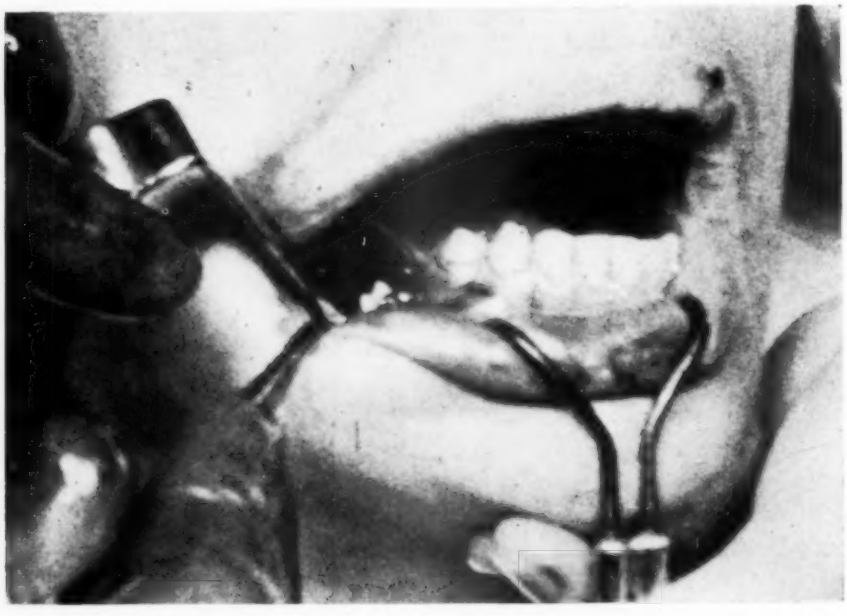

Fig. 2.—Photograph showing extent of cyst cavity. Both molar teeth can be readily visualized.

Operation.—Under mandibular nerve block an incision was made at a place which normally would be a few millimeters above the reflecture of the cheek on the buccal alveolus. The mucoperiosteum was stripped back uncovering white

glistening bone about the consisteney of an eggshell. The bone was removed with hand chisel and rongeurs in the shape of an elipse about 5 by 1.5 centimeters. The cyst membrane was then incised and a section of it corresponding with the bone window excised. About 30 c.c. of cyst fluid containing cholesterol were then evacuated. The cavity was washed with normal saline, clearly exposing both molar teeth (Fig. 2). Digital compression of the swelling extraorally produced a corresponding elevation of the bone into the cyst cavity.

Fig. 3.—Wound packed with iodoform gauze.

Fig. 4.—Obturator in place.

Because of the complete lack of osseous support it was decided that marsupialization of the cyst would be least likely to produce complications such as hemorrhage, numbness and possibly fracture. Therefore the mucous membrane was sutured to the cyst wall around the entire periphery of the wound and the cavity packed with iodoform gauze (Fig. 3).

The patient was seen forty-eight hours later. There was no bleeding and very little discomfort and the postoperative swelling was consistent with the mild surgical trauma. Numbness, not infrequently associated with manipulative trauma, was absent. Ten days later an obturator was constructed and the patient instructed to irrigate the wound at home (Fig. 4).

SUMMARY

Because of their innocuous nature, certain new growths arising in the buccal cavity may attain abnormally large dimensions. Surgical fracture, anesthesia, as well as hemorrhage, may complicate operative procedure.

Marsupialization, the method of choice in this instance, provides for the retention of teeth otherwise lost when enucleation of the growth is performed.

The obturator allows the patient to keep the wound clean during the process of healing and is quite easily managed at home.

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CASE NO. 80

REMOVAL OF IMPACTED THIRD MOLARS

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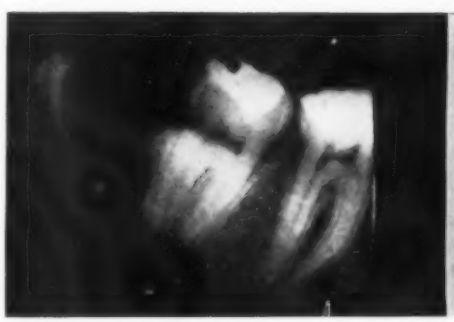
A WOMAN, aged 23 years, presented herself at my office July 3, 1930, for the removal of an impacted lower right third molar (Fig. 1). The oral examination revealed normal tissue tone and the radiographic examination showed evidence of pericoronal involvement. Local anesthesia was used, and the tooth was removed without incident. No postoperative radiograph was made. There were no postoperative complications, and healing occurred in the usual time.

This patient again presented herself Feb. 20, 1940, for the removal of the impacted lower left third molar (Fig. 2). The oral and radiographic examination revealed a similar condition to that of the right side except for a large radiolucent area located at and inferior to the periapical region of the impacted

Fig. 1.

Fig. 2.

Fig. 3.



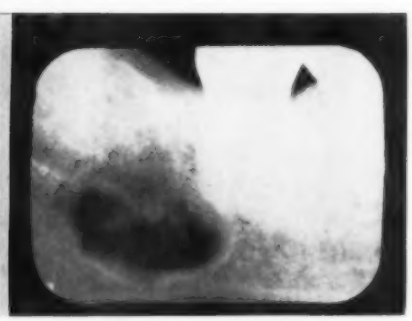


Fig. 4.

tooth. On March 2, 1940, under local anesthesia, this tooth was removed. Examination with curettes revealed hard, smooth bone with no soft tissue formation in the radiolucent area inferior to the impacted tooth. Extreme care was exercised in the use of the curettes in this area due to the proximity of the mandibular canal. The postoperative radiograph, Fig. 3, shows the area immediately after removal of the impacted tooth. The tooth socket was lightly packed with sterile iodoform gauze and changed every twenty-four hours for several days.

As on the right side, there were no postoperative complications and healing occurred uneventfully.

The radiograph in Fig. 4 was made Nov. 6, 1941, one year and nine months following the removal of the lower left impacted third molar. The radiograph in Fig. 5 was also made Nov. 6, 1941, eleven years and four months following the removal of the lower right impacted third molar. Figs. 6 and 7 are postoperative x-rays taken Nov. 9, 1942.

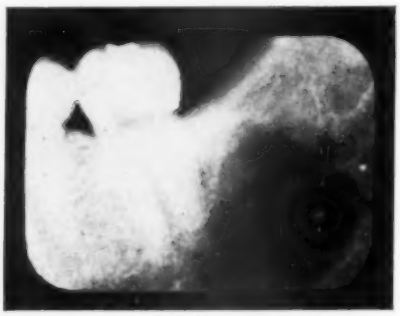


Fig. 5.

Fig. 6.

Fig. 7.

The patient, twelve years and four months after removal of the first tooth and two years and nine months after removal of the second tooth, has had no discomfort in either area at any time, neither before nor after removal of teeth.

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Editorial

Vitamin P

In the foreign literature a number of clinical studies have been reported in which the treatment with vitamin P gave favorable results in hemorrhagic diseases. Elmby and Warburg[1] have reported that occasional individuals with a hemorrhagic tendency associated with low ascorbic-acid levels in the blood fail to respond to the administration of excessive amounts of ascorbic acid. Three such subjects studied, however, did respond to the ingestion of lemon juice with a rise of the ascorbic-acid content in the blood and disappearance of the bleeding tendency. Lajos[2] has found citrin to be effective in decreasing capillary fragility and permeability in "vascular" purpuras and hemorrhagic nephritides. Similar results have been claimed by Raunvert[3] and Lotze.[4] Scarborough and Stewart[5] administered hesperidine to six patients with resulting improvement of the clinical condition and reduction of the capillary fragility. Three of these patients were exhibiting spontaneous petechial hemorrhages which had followed the administration of arsenic or bismuth. Jersild[6] reported a case of a young woman with a typical case of Schonheim-Henoch purpura of many years' standing which failed completely to respond to intravenous ascorbic-acid therapy. Treatment with citrin, however, dramatically alleviated the symptoms and markedly improved capillary resistance. Withdrawal of the citrin produced relapses. The patient was later placed on a diet so deficient in vitamin C that ascorbic acid all but disappeared from the blood, yet no return of symptoms occurred as long as citrin was regularly administered.

It is well known that capillary fragility is one of the earliest symptoms of vitamin C deficiency; it is the cause of bleeding gums associated with scorbutic gingivitis, one of the signs of acute scurvy. However, increased capillary fragility is not specific of scurvy, and a large number of factors influence the resistance of the capillaries. Liebmann, Wortis, and Wortis[7] have been unable to demonstrate any correlation of ascorbic acid in the various body fluids, and capillary fragility as determined by the positive-pressure, or negative-pressure, methods, and Armentano[8] was unable to get results by giving pure ascorbic acid. Claims, however, have been frequently made that a variety of hemorrhagic tendencies due to increased capillary fragility respond to the use of natural sources of vitamin C. Armentano, Bentsath, Beres, Rusznyak, and Szent-Györgyi[9] also failed to get results with pure ascorbic acid while the crude preparations of vitamin C were effective in the treatment of certain types of

[1]Elmby and Warburg: Lancet **2**: 1363, 1937.
[2]Lajos: Klin. Wchnschr. **16**: 1615, 1937.
[3]Raunvert: Ztschr. f. Urol. **32**: 630, 1938.
[4]Lotze: Ztschr. f. d. ges. exper. Med. **102**: 696, 1938.
[5]Scarborough and Stewart: Lancet **2**: 610, 1938.
[6]Jersild: Lancet **1**: 1445, 1938.
[7]Liebmann, Wortis, and Wortis: Am. J. M. Sc. **196**: 388, 1938.
[8]Armentano: Ztschr. f. klin. Med. **129**: 685, 1936.
[9]Armentano, Bentsath, Beres, Rusznyak, and Szent-Györgyi: Deutsche med. Wchnschr. **62**: 1325, 1936.

purpura. They therefore drew the conclusion that the natural sources of the vitamin contain some active constituent which is lost in the process of purification. The active constituent of these extracts was isolated in crystalline form as a mixture of flavone glucosides, which was named "citrin" or vitamin P. Later Bruckner and Szent-Györgyi[10] identified the active flavones as hesperidine and eriodictyol glucoside. The administration of 40 mg. of extract per day to patients who reacted abnormally to the capillary resistance test, by the suction method, and the capillary permeability test of Landis, restored normal conditions of the capillaries.

Scarborough[11] reported the result of more extensive investigations which demonstrated that in human subjects, suffering from spontaneous, conditioned, and induced multiple vitamin deficiencies of varying degree of severity in which the capillary fragility was increased, the resistance of the capillary walls to the application of pressure was improved by the administration of a substance or substances flavanone in nature and found in extracts of orange and lemon juices. These substances were active when given by mouth, rectally, or by intramuscular injection. The decrease in capillary fragility was produced in every case even when ascorbic acid, given by mouth or by injection, had failed to produce this effect.

These clinical reports seem very interesting. Ivy and Gray[12] point out that they are not extensive enough to establish the therapeutic value of vitamin P. Animal experiments have not as yet been devised to support the theory of the effect of these substances, and no application as yet has been made to the treatment of diseases of the oral mucosa.

K. H. T.

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[10]Bruckner and Szent-Györgyi: Nature **138**: 1057, 1936.

[11]Scarborough, H.: Vitamin P, Biochemical Journal **33**: 2nd, 1400, 1939.

[12]Ivy and Gray: The Application of Recent Contributions in Basic Medical Sciences to Surgical Practice, Surg., Gynec. and Obst. **69**: 1, 1939 (Section-International Abstract of Surgery).

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